Conclusions: EPIC-CP was highly endorsed from healthcare practitioners and prostate patients across participating cancer centres. The EPIC-CP tool captures prostate-specific symptom information that assists in enhancing clinical care and symptom management. Provincial roll-out of EPIC-CP as a standard of care for PROs in clinical practice is recommended.

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INCREASING USE OF ACTIVE SURVEILLANCE AMONGST RADIATION ONCOLOGISTS IN CANADA

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Purpose: To determine the preferences of radiation oncologists in Canada for treatment of low-risk and intermediate-risk prostate cancer in an era when no "gold standard" has been defined.
Methods and Materials: A 20-item email questionnaire was sent to all practising radiation oncologist in Canada. Responses were collected over a four-week interval and are reported anonymously as aggregate.
Results: Thirty-three responses were collected from 10 provinces. All but two respondents treated prostate cancer routinely and saw between six and 30 new patients per month. Seventeen out of 31 (55%) prostate cancer treating respondents indicated they recommended active surveillance (AS) more frequently now compared to five years ago, whereas eight (26%) have not made a change in practice. Twenty-two (68%) respondents cited the Klotz criteria (PSA ≤ 10ng/mL, Gleason score of ≤ 6 or age ≥ 70 years and PSA ≤ 15 and Gleason score of ≤ 3 + 4) or patient preference as reasons for offering AS. Twenty-five (81%) would first recommend AS for low-risk prostate cancer. Almost all respondents would take the patient off AS for disease progression of any type (pathologic, clinical, or biochemical) or if the patient decided for treatment with no progression of disease. Twenty-two (69%) felt radical prostatectomy (RP) and brachytherapy (BT) were equivalent. Two (6%) felt cure rates were better with RP and eight (25%) felt BT cure rates were better. Eighteen (56%) of respondents would only recommend BT to patients with intermediate-risk prostate cancer; nine (28%) would outline options of BT, RP and external beam radiotherapy (EBRT). If BT was not a treatment option, then 18 (56%) respondents would support RP over EBRT.
Conclusions: This survey confirmed that AS is more strongly favoured across Canada by radiation oncologists who treat low and select intermediate-risk prostate cancer. BT and RP continue to be the preferred recommendations. There was a bias towards belief that BT cure rates are better despite the lack of randomized evidence. EBRT is felt by most to be less curative than either RP or BT.

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RESULTS OF A PHASE I/II TRIAL OF 5 FRACTION STEREOTACTIC RADIOSURGERY WITH CONCURRENT AND ADJUVANT TEMOZOLOMIDE IN NEWLY DIAGNOSED SUPRATENTORIAL GLIOBLASTOMA MULTIFORME

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Purpose: To determine the maximum tolerated dose (MTD) of 5 fraction stereotactic radiosurgery (SRS) delivered with concurrent and adjuvant temozolomide (TMZ) in newly diagnosed glioblastoma multiforme (GBM).
Methods and Materials: Adult patients with newly diagnosed GBM were treated with escalating doses of SRS in a 3+3 design on 4 dose levels: 25 Gy, 30 Gy, 35 Gy, and 40 Gy targeting the cavity/residual tumour with a 5 mm CTV margin and 0 mm PTV. There were 2 arms per PTV size: < 60 cm^3 (Arm 1) and 60-150 cm^3 (Arm 2). A dose limiting toxicity (DLT) was defined as CTCAE Grade 3-5 CNS toxicity within 30 days of SRS, with life-long assessment for late SRS-related adverse radiation effect (ARE). The maximum tolerated dose (MTD) was the highest dose where 0-1 out of six had an acute or late CNS Grade 3-5 toxicity. Secondary endpoints included progression free survival (PFS) and overall survival (OS). Given the difficulty in interpreting post-SRS imaging, any new enhancement was scored as: 1) tumour progression, if ultimately determined to be recurrent tumour (PD); 2) transient ARE if occurred within five months and resolved (i.e., pseudoprogression, PP); 3) persistent ARE (i.e., radionecrosis, RN). All AREs were scored per CTCAE.
Results: From 2010 to 2015, 30 total patients were enrolled. The median age was 66 with median KPS of 80. The median GTV was 26.8 cc (range 3.8–81.0 cc) with a PTV of 60.2 cc (range 14.7–137.3). Protocol defined DLTs occurred in 2 patients: one admitted for PD at 3 weeks (Grade 4, Arm 2, Dose 40 Gy); another patient died 1.5 weeks post-SRS from suspected post-operative complications (Grade 5, Arm 1, Dose 40 Gy). AREs occurred in 11 patients: five cases of PP occurring at a median time of 2.8 months from SRS (range 0.8-3.4); 6 cases of RN (Grade 1 n = 2, Grade 2 n = 4) at 6.9 months (range 3.2–12.6). All patients with PP and all but one with RN had MGMT methylated tumours. Extent of resection (HR 0.19) and MGMT methylation (HR 0.36) were associated with improved OS on multivariate analysis. RN was not associated with increase in dose, GTV or PTV volume. Ultimately, 25 (83%) of patients were treated with bevacizumab, started in 17% for symptomatic transient ARE, 6% for persistent ARE, and 60% for PD. With a median follow up of 12.9 months, the median OS for all patients was 15.0 months, with a median PFS of 6.37 months. Median OS was 20.0 months for patients with MGMT methylated tumours, versus 11.3 months for MGMT unmethylated (p = 0.046). Presence of RN was associated with improved median OS (33.2 versus 11.3 months; p = 0.024). Amongst MGMT methylated patients who developed RN, median OS was 33.5 versus 16.9 months for those without RN (p = 0.10).
Conclusions: The primary endpoint of dose escalation to 40 Gy was achieved without severe treatment-related toxicity. However, a dose recommendation based on tumour size cannot be made. These results suggest that SRS with concurrent TMZ constitutes a safe and feasible treatment for GBM with OS comparable to conventional fractionation.

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IS FOLEY CATHETER AN ADEQUATE SURROGATE FOR URETHRA WHEN PLANNING HIGH-DOSE RATE PROSTATE BRACHYTHERAPY?

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Purpose: To assess adequacy of a Foley catheter for urethral delineation for evaluation of urethral dose in high-dose rate prostate brachytherapy(HDR-PB).
Methods and Materials: Twenty-one sets of prostate ultrasound images were recorded with and without a Foley catheter in place. The first images were obtained during HDR-PB for intraoperative planning with a Foley catheter in-situ. A standard 6mm-diameter circle was used to delineate the catheter on transverse images, assuming that it represented the urethra. Dosimetric optimization parameters were Prostate V100%≥98%, V125%: 55-62% and D90% ≥ 100% and urethral V115% = 0 cc. After treatment, another set of images was recorded after removing the catheter and instilling aerated gel into the urethra without removing the brachytherapy needles or changing the patient's position. The images were fused using either Vitesse3.0 or BrachyVision11.0. Urethral dosimetric parameters, position and volume of the urethra were compared. Paired Student's t-tests were performed for statistical analysis.
Results: Images were recorded on 16 intermediate to high-risk prostate cancer patients who received HDR-PB boost combined with 46 Gy/23 fractions external beam radiotherapy. Eight had two fractions of 10 Gy in separate implants and the remaining eight received 15 Gy in one fraction. Twenty-one paired sets of

prostate ultrasound images with either a Foley or gel were fused and analyzed. The catheter tends to take a path of least curvature and is thus located in the anterior urethra. At mid-prostate the difference is most pronounced with the posterior edge of the catheter located up to 7 mm anterior to the posterior aspect of the gel-filled urethra. Urethra V115% was higher when the urethra was defined with gel. Median V115% was 0 cc (0-0.03) with catheter compared to 0.03 cc (0-0.53) with gel ($p = 0.02$) and translated to a median V115% of 0% (0-2.14) versus 3.23% (0-20.95) ($p = 0.003$), respectively. Only one patient when analyzed with the gel had a V118% > 10%(16.6%) and three had a V125% > 0 cc ($p = 0.31$). The urethral volume was 1.4 cc (1.04-1.85) using the 6mm circle and was 1.22 cc(0.7-2.53) when using aerated gel ($p = 0.522$). At the prostate base and apex the smaller diameter of the urethra makes visualization with gel alone difficult.

Conclusions: Using a Foley catheter for urethral identification and dose prescription underestimates the dose that is actually received by some patients. Urethral curvature differs from the Foley catheter, especially at mid gland where the catheter rides anteriorly. A standard 6 mm circle does not represent the entire urethral volume. Although we have not observed unexpected toxicity, we will continue to monitor actual urethral dose to correlate with toxicity in future patients. In the meantime, use of a catheter is the most reliable means of visualizing the entire length of the prostatic and membranous urethra. Consideration could be given to expanding the 6 mm circle in the posterior direction in mid-gland.

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LONG-TERM OUTCOMES OF A PHASE II TRIAL OF MODERATE HYPOFRACTIONATED IMAGE-GUIDED INTENSITY MODULATED RADIOTHERAPY (IG-IMRT) FOR LOCALIZED PROSTATE CANCER

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Purpose: To evaluate long-term biochemical control (bRFR) and radiation toxicity for men with localized prostate cancer treated with two moderately hypofractionated IG-IMRT regimens.
Methods and Materials: Eligible consenting men with T1c-T3a Nx M0 prostate cancer were enrolled in a Phase II trial and received IG-IMRT to a risk-adapted volume that included prostate +/- seminal vesicles at 3 Gy per fraction, 5 days per week in sequential cohorts to a total dose of either 60 Gy or 66 Gy. Late gastrointestinal (GI) and genitourinary (GU) toxicity were recorded at each follow up using the Radiation Therapy Oncology Group criteria and biochemical failure was scored using the PSA nadir+2 criteria. Outcome estimates were calculated using the Kaplan-Meier method and log rank test. Early stopping rules terminated accrual to the 66 Gy cohort due to excessive Grade 3-4 late toxicity.
Results: Ninety-six men received 6 0Gy and 28 received 66 Gy. Androgen deprivation therapy (3-36 months duration) was used in 10% of men in both cohorts. For each cohort, the median age was 71 years (60 Gy) and 70 years (66 Gy). Low or intermediate-risk presentation was respectively 27% and 65% (60 Gy) and 25% and 71% (66 Gy). Median follow up was 128 months (60 Gy) and 108 months (66 Gy). The five- and eight-year bRFR for 60 Gy and 66 Gy were respectively 83% and 67% versus 88.5% and 73.4% ($p = 0.224$). For each cohort, five (60 Gy) and one (66 Gy) subjects died from disease. Overall five- and eight-year cumulative late Grade 1-4 GI toxicity for 60 Gy versus 66 Gy were respectively 21.2% and 21.2% versus 44.6% and 48.9% ($p = 0.004$). Cumulative late Grade 1-4 GU toxicities were respectively 23.8% and 32.8% versus 40.4% and 51.4% ($p = 0.048$). Cumulative five- and eight-year late Grade 3-4 GI toxicity for 60 Gy and 66 Gy were respectively 1.1% and 1.1% versus 11.5% and 11.5% ($p = 0.01$). Cumulative five- and eight-year late Grade 3-4 GU toxicity for 60 Gy and 66 Gy were respectively 0 and 1.5% versus 3.7% and 3.7% ($p = 0.41$). At last follow up in the 60 Gy cohort there were no Grade ≥ 3 late GI toxicities and one Grade 3 late GU toxicity. In the 66 Gy cohort there was one Grade 4 late GI toxicity and one Grade 4 late GU toxicity.
Conclusions: Moderate hypofractionation to 60 Gy was associated with modest late toxicity and provided excellent five-year bRFR for our patients, although failures continued to be observed with subsequent follow up. Dose escalation to 66 Gy was associated with significantly worse late GI and GU toxicity without an apparent improvement in bRFR.

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RADIATION PNEUMONITIS IN PATIENTS WITH INTERSTITIAL LUNG DISEASE TREATED WITH LUNG STEREOTACTIC RADIATION THERAPY

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Purpose: To determine the impact of pre-treatment interstitial lung disease (ILD) on radiation pneumonitis and overall survival (OS) in patients treated with lung SBRT.
Methods and Materials: Patients treated with lung SBRT between October 2004 and July 2015 at our institution were included. Pre-treatment CT scans were reviewed by experienced thoracic radiologists and interstitial changes including ground glass opacities (GGO), reticulations and honeycombing were scored and involvement to the nearest 5% was used to calculate Washko and Kazerooni scores. Radiation pneumonitis (RP) was prospectively documented using the CTCAE V4.0 criteria. Pre-treatment imaging characteristics, lung and heart dose parameters and clinical variables including smoking status and pulmonary function were assessed by univariate (UVA) and multivariate analysis (MVA). OS was assessed by log rank test and impact of ILD on overall survival was assessed by Cox regression.
Results: Five hundred and forty-two patients were assessed with 56 having evidence of interstitial changes on pre-treatment scans. These included 12 cases of usual interstitial pneumonia (UIP), 18 cases of possible UIP, nine cases of non-specific interstitial pneumonia and 17 cases of age-related reticulations thought to be unrelated to ILD. RP was significantly higher in the 39 patients with ILD (Grade ≥ 2 20.5% versus 5.8%, $p < 0.01$; Grade ≥ 3 10.3% versus 1.0%, $p < 0.01$). Of the three cases of Grade 5 RP observed in our series, two had imaging features of ILD. On UVA, radiographic evidence of ILD, Washko score, lung parameters (V5/V10/V15/V20/mean lung dose) and performance status were significant predictors of Grade ≥ 2 RP. Age-related reticulations were not associated with increased toxicity. On MVA, ILD (OR 5.18, $p < 0.01$) and mean lung dose (OR 1.003, $p < 0.01$) were predictors of RP. ILD did not significantly affect OS on UVA or MVA. Median survival was 26.5 months in the ILD cohort and 36.6 in the ILD negative cohort ($p = 0.09$).
Conclusions: Radiographic evidence of ILD is a significant risk factor for RP in patients treated with lung SBRT, but did not impact OS. CT scans should be reviewed for evidence of ILD prior to SBRT and involvement of respirology for management is essential. If ILD patients are treated with SBRT, they should be monitored closely for RP.

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EVALUATION OF AN AUTOMATED DEFORMABLE REGISTRATION ALGORITHM FOR MRI-GUIDED FOCAL BOOST INTEGRATED WITH ULTRASOUND-BASED HIGH DOSE-RATE BRACHYTHERAPY IN THE TREATMENT OF PROSTATE CANCER

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Purpose: Real-time transrectal ultrasound (TRUS) image guidance for prostate high dose-rate brachytherapy (HDR-BT)